FOSSIL DOLPHIN BONES FROM THE CHATHAM ISLANDS, NEW ZEALAND

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ABSTRACT

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A periotic (earbone) from an uncertain horizon within a condensed limestone sequence on Chatham Island, New Zealand, represents a species of the Late Miocene to Recent family Delphinidae (dolphins). It cannot be identified clearly below family level, but there are similarities with *Delphinus* and *Stenella*. A tympanic bulla may represent the same species. A single-rooted tooth of possible but not certain Eocene age, may represent a primitive cetacean. These are the first cetacean fossils described from the Chathams.

KEYWORDS: Cetacea - Delphinidae - fossil - Chatham Islands - New Zealand - Miocene - systematics.

INTRODUCTION

Dolphin earbones (Odontoceti: Delphinidae) are known from Neogene phosphorites on Chatham Rise east of the South Island of New Zealand (Fordyce 1984, 1989), but bones of dolphins or, indeed, any other Cetacea, have not been described from the nearby Chatham Islands. The Chatham Rise fossils provide some evidence about the time of phosphorite accumulation, since well-identified delphinids outside the New Zealand region have not been reported from rocks older than Late Miocene. Similarly, despite its rather undiagnostic appearance, the Chatham Island periotic briefly described here has stratigraphic implications, since it comes from a sequence originally thought to have been of Late Eocene age (Hay *et al.* 1970).

The earbones have previously been mentioned briefly in the literature (Fordyce 1989), but have not been considered formally.

DESCRIPTION

Delphinidae genus and species indeterminate

COLLECTION DATA AND REPOSITORY

The two earbones are: specimen number CD 53 (Phylum Chordata catalogue, New Zealand Geological Survey, Lower Hutt), a dark left periotic which lacks the pars cochlearis (Fig. 1a,b) and which is probably secondarily phosphatised; and specimen number CD 52, a dark fragment of left tympanic bulla (Fig. 1c) which retains only part of the involucrum and part of the floor of the tympanic cavity, also probably secondarily phosphatised. The earbones were collected by H.J. Campbell, P.A. Maxwell and J.S. Buckeridge in March 1981, from locality CH/f526 (fossil record number in the New Zealand Fossil Record file based on the 1: 50 000 map series NZMS 260), New Zealand Geological Survey collection GS 12998. This is a borrow pit created during construction of the Inia William Tuuta Memorial Aerodrome near Moutapu Point, Chatham Island. The grid reference is NZMS 260 CH/521698, or latitude 43° 49.3′S, longitude 176° 28.4′W. Because the quarry site is disturbed, it is not clear whether the earbones were collected from outcrop or from large blocks of limestone that had been moved during quarry operations.

STRATIGRAPHY AT LOCALITY CH/F526

The earbones were thought originally to

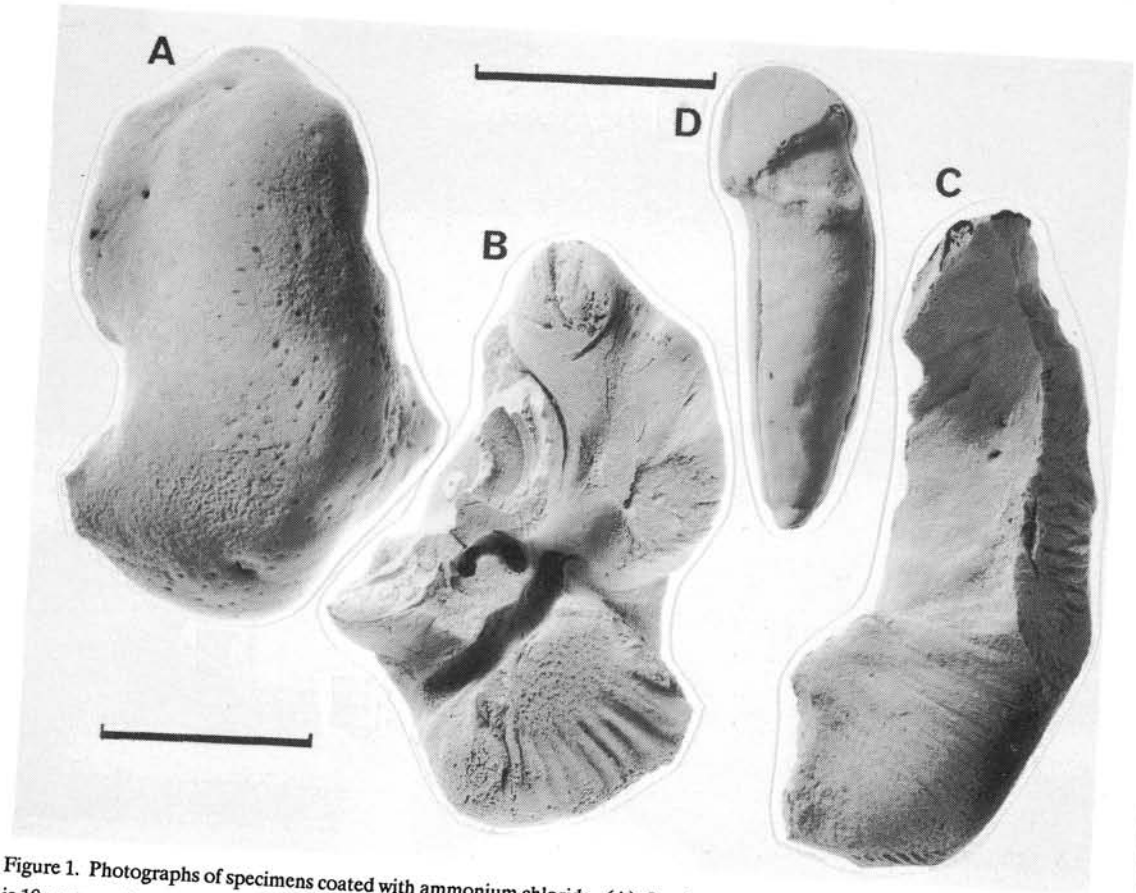

Figure 1. Photographs of specimens coated with ammonium chloride. (A) Specimen CD 53, left periotic, dorsal view (scale bar is 10 mm; specimen about x 2.9 magnification). (B) Specimen CD 53, left periotic, ventral view (scale as for A). (C) Specimen CD 52, left tympanic bulla, dorsal view (scale as for A). (D) Specimen CD 538, anterior tooth, buccal view (scale bar is 10 mm; specimen about x 3.3 magnification).

come from the Te Whanga Limestone (*sensu* Hay *et al.* 1970; cf. Campbell *et al.* 1988), of Bortonian-Kaiatan age (Late Eocene). Once the periotic was identified it seemed that the source horizon was unlikely to be older than Miocene, based on the known age range of Delphinidae (see below). Subsequently, an analysis by G.H. Scott and H.E.G. Morgans (pers. comm. to H.J. Campbell) of foraminifera from sample CH/f526, now known to lie within the "unnamed Altonian limestone" of Campbell *et al.* (1988: 301-2), revealed the presence of taxa including *Amphicoryne scalaris*, *Bolivina reticulata*, *Rectuvigerina* aff. *vesca*, *Globocassidulina subglobosa*, *Globocassidulina arata*, *Cassidulina* sp., *Melonis maorica*, *Oridorsalis tenera*, *Hanzawaia turgida*, *Euvigerina* sp., *Gyroidinoides zelandica*, *Gyroidinoides neosoldanii*, *Cibicides novozelandicus*, *Cibicides* cf. *molestus*, *Globigerina woodi*, *Globigerina ciperoensis*, *Globigerinoides trilobus*, *Globorotalia miozea*, *Globorotalia zealandica*, *Fohsella peripheroronda*, and *Sphaeroidinellopsis* cf. *disjuncta*. The planktic assemblage indicates an Altonian age, or later Early Miocene. The associated marine fauna, which is not particularly age diagnostic, includes cirripedes (Buckeridge 1984), scleractinians, alcyonarians, sponges, serpulids, echinoderms, gastropods, bivalves, brachiopods and sharks.

The delphinid periotic suggests an age no older than Late Miocene (below), and there is other evidence that the cetacean bones are not necessarily as old as the Altonian age obtained

for foraminifera from sample CH/f526. Campbell *et al.* (1988: 301) mentioned that the "unnamed Altonian limestone" includes a phosphatised horizon that may indicate the top of this problematic unit. Campbell *et al.* further suggested that the phosphatised horizon may correlate with the basal phosphatised horizon in the Motarata Limestone (of Campbell *et al.* 1988: 303-4), of Opoitian (Pliocene) age. The dark colour of the apparently secondarily phosphatised periotic and bulla suggests strongly that they came from this phosphatised horizon rather than an unphosphatised horizon within "unnamed Altonian limestone". Thus the earbones are probably younger than Altonian but older than Opoitian.

MORPHOLOGY

The features of the incomplete small (length 28.3 mm) left periotic (CD 53) are shown in Fig. 1a and 1b. (For terminology used here, see e.g., Fordyce 1983.) This element matches the periotics of other Delphinidae in that the anterior process is relatively short and laterally compressed, the parabullary ridge is prominent, there is no lateral tuberosity, and there are no deep depressions for the anterior pedicle or accessory ossicle. The mallear fossa is small, and there is no obvious fossa incudis; the hiatus epitympanicus is relatively narrow and smooth. A long, narrow stapedial muscle fossa is separated indistinctly from the path for the facial nerve. As is common in living delphinids, the posterior process is short, concave and somewhat externally-produced, and the posteroexternal portion of the posterior process carries subparallel coarse striae for contact with the facet of the tympanic bulla. The facet for the bulla does not extend to the posterior of the periotic, but finishes a little anterior to the posterior profile.

There are few other noteworthy features; parts of the coils of the cochlea and the semicircular canals are visible in broken section. There is a prominent transverse saddle ventrally between the anterior of the parabullary ridge and the almost nodular apex of the anterior process, and the pars cochlearis, now missing, appears to have been applied closely to the anterior process.

The fragment of bulla (CD 52; Fig. 1c) is too incomplete to warrant detailed description. Of note is the relatively small size (length $\geqslant$ 32 mm), comparable to that of the periotic, the dorsoventrally flattened posterior of the involucrum, the laterally wide anterior of the tympanic cavity, and the abruptly depressed external face of the involucrum.

RELATIONSHIPS

Many fossil delphinid periotics have been described or figured in the literature. Kasuya's (1973) atlas of earbones of extant odontocetes often allows problematic fossil specimens to be matched with extant taxa on the basis of overall similarity. However, since patterns of synapomorphies have not been listed for taxa within the Delphinidae, it is difficult to determine whether perceived similarities between earbones are ontogenetic and/or plesiomorphic, apomorphic or homoplasous. Unless there is exact match of profiles and topography between earbones, it is thus difficult to comment on the taxonomic significance of similarities. The partial periotic CD 53 matches the general profile of those of extant species of *Delphinus* and *Stenella* and it could represent a species from one of these genera. However, the posterodorsal profile of the posterior process meets the body at a more rounded angle than shown in illustrations of the earbones in the extant taxa. The periotic is otherwise too incomplete to be sure of its identity below the family level.

The bulla could represent the same species, and indeed could represent the same individual as the periotic. However, the bulla could represent a species in some other family of small odontocetes.

Cetacea genus and species indeterminate

COLLECTION DATA AND REPOSITORY

The specimen is number CD 538 (Phylum Chordata catalogue, New Zealand Geological Survey, Lower Hutt), a worn single-rooted tooth (Fig. 1d) which is black and thus probably secondarily phosphatised. The tooth was collected by R.J. Stanley, from locality CH/f278, New Zealand Geological Survey collection GS 12050. This locality, Blind Jims Creek, is west of Te Whanga Lagoon, Chatham Island (see locality map of Campbell *et al.* 1988: Fig. 3, and com-

ments by Keyes 1987). The grid reference is NZMS 260 CH/455744, or latitude 43° 46.8'S, longitude 176° 33.3'W.

STRATIGRAPHY AT LOCALITY CH/F278

The tooth is from an uncertain horizon, but is probably from within the Matanginui or Te One Member of the Te Whanga Limestone (*sensu* Campbell *et al.* 1988: 297-299) of age range Mangaorapan to Heretaungan (Early Eocene) or Bortonian to Runangan Stages (Middle to Late Eocene). Elsewhere to the west of Te Whanga Lagoon, the Te One Limestone is known to range up to Whaingaroan (Early Oligocene). It is possible that the tooth was derived from a younger unit no longer represented at the site.

MORPHOLOGY

The features of this small tooth are shown in Fig. 3. The crown is blunt, relatively low, and laterally compressed (height approx. 5 mm, maximum length 6.4 mm, maximum width 5.6 mm), with smoothly concave anteroposterior keels. The crown is recurved slightly lingually. It has no significant ornament. The surface of the tooth is polished, and fine details may have been lost by post mortem wear, but there is no evidence of any prominent original ornament. The root retains on its buccal face a little of what was originally perhaps thick cementum. Most of the root is formed by presumed dentine. The root is roughly cylindrical, somewhat compressed anteroposteriorly, and tapers distally. There is a tiny hole at the apex which probably indicates the former opening to the pulp cavity.

The curvature of the root and crown suggest that this is an upper left or lower right anterior tooth, probably an incisor or canine, of a heterodont cetacean. It is likely that the tooth was placed laterally, rather than medially, since the root is skewed posteromedially relative to the long axis of the crown.

RELATIONSHIPS

This tooth is identified as mammalian because it is thecodont with thick enamel and cementum. It is identified provisionally as cetacean because its profiles, particularly the backward skew of the root, suggest placement in an elongate jaw or rostrum. No clear cetacean synapomorphies are apparent, but a cetacean identification is compatible with an origin from marine later Eocene or Oligocene sediments. There is no obvious similarity with teeth of Pinnipedia, the other group of marine mammals that might be considered.

If such a tooth were found in Eocene sediments elsewere in the world (e.g., the Atlantic coastal plain in North America, bordering the western North Atlantic), it would probably be identified as that of an archaeocete (Cetacea: Archaeoceti - archaic whales). Since the opening to the pulp cavity is closed, the tooth is more likely to be from a mature animal that represents a small species, than from a juvenile animal that represents a large species. Described species of basilosaurid archaeocetes have larger teeth than this, so basilosaurid affinities seem unlikely. Not enough is known about other archaeocetes (protocetids, remingtonocetids), primitive odontocetes, or primitive toothed mysticetes to allow useful comment. Isolated teeth of profiles crudely similar to that of CD 538 have been described elsewhere in the world as those of odontocetes (e.g., kentriodontids and squalodelphids), but most of the well-preserved odontocete teeth from heterodont dentitions carry vestigial cusps or strong ornament (e.g., as shown by Kellogg 1955) not seen here, and are more circular in cross section in contrast to this laterally compressed crown. Thus, affinities with primitive Cetacea are possible. It is unlikely that relationships can be determined until more material is found.

DISCUSSION

Fossil Delphinidae from the New Zealand region have not received much attention in print. The only specimen to have been described in any detail is a jaw similar to that of *Delphinus* or *Stenella* from the mid Pliocene of Taranaki (McKee & Fordyce 1987). Undescribed fossils are known (e.g., Fordyce 1982). No older stratigraphically well placed specimens have been described from New Zealand, although they might be expected, and overseas fossils provide the best stratigraphic records. The oldest definite Delphinidae known are recognised from skulls of

Late Miocene age, about 11 million years old (e.g., Barnes *et al.* 1985: 21). There is no independent evidence to suggest that the Chathams periotic discussed here is significantly older, for example, Altonian (Early Miocene).

It seems likely that, with the increase in knowledge of the stratigraphic distribution of Cetacea, easily identifiable elements such as earbones may become more useful in stratigraphy than in the past. Such fossils are most unlikely to supplant calcareous macrofossils or microfossils in value, but they may be useful in providing age constraints for well-cemented and/or phosphatised horizons that often yield rather undiagnostic calcareous biotas.

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